

**CLAIMS**

What is Claimed is:

- 1           1.     A thermal indicator for visually determining and monitoring  
2 temperature, comprising:
  - 3           a)     indicating means capable of moving from a first position to a second  
4 position for indicating when a preselected temperature has been reached; and
  - 5           b)     a thermopolymeric switching medium for allowing said indicating  
6 means to dynamically indicate when said preselected temperature has been  
7 reached, wherein said thermopolymeric switching means comprises at least one  
8 thermopolymeric material that, when at a temperature below the predetermined  
9 temperature, maintains said indicating means at the first position, and that, when  
10 at a temperature equal to or higher than the predetermined temperature, yields to  
11 permit release of said indicating means to the second position.
- 1           2.     The thermal indicator as claimed in Claim 1, wherein the  
2 thermopolymeric switching medium is an organic polymer.
- 1           3.     The thermal indicator as claimed in Claim 1, further comprising at  
2 least one inert additive selected from the group consisting of sugars, salts,  
3 starches, cellulose non-melting metal filings, powdered plastics, polymers, silicon,  
4 silicates, chromatography resins, ceramic resins, chalk, glass, sand, air, oils,  
5 water, and high boiling liquid polymeric materials, and combinations thereof.
- 1           4.     The thermal indicator as claimed in Claim 3, wherein the inert  
2 additive is present in an amount between 0.1% to 99% by weight of  
3 thermopolymeric switching medium.
- 1           5.     The thermal indicator as claimed in Claim 3, wherein the inert  
2 additive is present in an amount between 5% to 95% by weight of  
3 thermopolymeric switching medium.
- 1           6.     The thermal indicator as claimed in Claim 3, wherein the inert  
2 additive is present in an amount between 10% to 90% by weight of  
3 thermopolymeric switching medium.
- 1           7.     The thermal indicator as claimed in Claim 3, wherein the inert

2 additive is present in an amount between 20% to 80% by weight of  
3 thermopolymeric switching medium.

1 8. The thermal indicator as claimed in Claim 1, further comprising at  
2 least one interactive additive selected from the group consisting of bee's wax, root  
3 extracts, long chain hydrocarbon analogs from the jojoba plant, petroleum  
4 distillation analogs, and synthetic organic analogs, and combinations thereof.

1 9. The thermal indicator as claimed in Claim 8, wherein the at least one  
2 interactive additive is selected from the group consisting of short and long chain  
3 alcohols, esters, acrylic esters, fluorinated hydrocarbons, docosanol (C22),  
4 tricosanol (C23), tetracosanol (C24), pentacosanol (C25), hexacosanol (C26),  
5 heptacosanol (C27), octacosanol (C28), nonacosanol (C29), triacontanol (C30)  
6 and extended analogs, and combinations thereof.

1 10. The thermal indicator as claimed in Claim 8, wherein the at least one  
2 interactive additive is present in an amount between 0.1% to 99% by weight of  
3 thermopolymeric switching medium.

1 11. The thermal indicator as claimed in Claim 8, wherein the at least one  
2 interactive additive is present in an amount between 5% to 95% by weight of  
3 thermopolymeric switching medium.

1 12. The thermal indicator as claimed in Claim 8, wherein the at least one  
2 interactive additive is present in an amount between 10% to 90% by weight of  
3 thermopolymeric switching medium.

1 13. The thermal indicator as claimed in Claim 8, wherein the at least one  
2 interactive additive is present in an amount between 20% to 80% by weight of  
3 thermopolymeric switching medium.

1 14. The thermal indicator as claimed in Claim 1, further comprising at  
2 least one emulsifier selected from the group consisting of lipids, long chain  
3 alcohols, lecithins, glycol lipids, quaternized amines with lipid tails, and charged  
4 ionic detergents, and combinations thereof.

1 15. The thermal indicator as claimed in Claim 14, wherein the at least  
2 one emulsifier is present in an amount between 0.001% to 10% by weight of  
3 thermopolymeric switching medium.

1           16.    The thermal indicator as claimed in Claim 14, wherein the at least  
2 one emulsifier is present in an amount between 0.01% to 5% by weight of  
3 thermopolymeric switching medium.

1           17.    The thermal indicator as claimed in Claim 14, wherein the at least  
2 one emulsifier is present in an amount between 0.1% to 1% by weight of  
3 thermopolymeric switching medium.

1           18.    A thermal indicator for visually determining and monitoring  
2 temperature, comprising:

3           a)     a barrel having an orifice communicating with a cavity within said  
4 barrel, said barrel being adapted for insertion into the article to be monitored;

5           b)     an indicator disposed in said cavity and adapted for sliding travel  
6 therein between a retracted position and an extended position;

7           c)     means for resiliently biasing said indicator away from said retracted  
8 position and toward said extended position; and

9           d)     thermopolymeric switching medium for releasably retaining said  
10 indicator in said retracted position,

11           wherein said thermopolymeric switching medium, when at a temperature  
12 below the predetermined temperature, maintains said indicator in said retracted  
13 position, and when at a temperature equal to or higher than the predetermined  
14 temperature, yields to permit release of said indicator, said biasing means urging  
15 said plunger into said extended position for visual indication.

1           19.    The thermal indicator as claimed in Claim 18, wherein the  
2 thermopolymeric switching medium is an organic polymer.

1           20.    The thermal indicator as claimed in Claim 18, further comprising at  
2 least one inert additive selected from the group consisting of sugars, salts,  
3 starches, cellulose non-melting metal filings, powdered plastics, polymers, silicon,  
4 silicates, chromatography resins, ceramic resins, chalk, glass, sand, air, oils,  
5 water, and high boiling liquid polymeric materials, and combinations thereof.

1           21.    The thermal indicator as claimed in Claim 20, wherein the inert  
2 additive is present in an amount between 0.1% to 99% by weight of  
3 thermopolymeric switching medium.

1           22.    The thermal indicator as claimed in Claim 20, wherein the inert  
2   additive is present in an amount between 5% to 95% by weight of  
3   thermopolymeric switching medium.

1           23.    The thermal indicator as claimed in Claim 20, wherein the inert  
2   additive is present in an amount between 10% to 90% by weight of  
3   thermopolymeric switching medium.

1           24.    The thermal indicator as claimed in Claim 20, wherein the inert  
2   additive is present in an amount between 20% to 80% by weight of  
3   thermopolymeric switching medium.

1           25.    The thermal indicator as claimed in Claim 18, further comprising at  
2   least one interactive additive selected from the group consisting of bee's wax, root  
3   extracts, long chain hydrocarbon analogs from the jojoba plant, petroleum  
4   distillation analogs, and synthetic organic analogs, and combinations thereof.

1           26.    The thermal indicator as claimed in Claim 25, wherein the at least  
2   one interactive additive is selected from the group consisting of short and long  
3   chain alcohols, esters, acrylic esters, fluorinated hydrocarbons, docosanol (C22),  
4   tricosanol (C23), tetracosanol (C24), pentacosanol (C25), hexacosanol (C26),  
5   heptacosanol (C27), octacosanol (C28), nonacosanol (C29), triacontanol (C30)  
6   and extended analogs, and combinations thereof.

1           27.    The thermal indicator as claimed in Claim 25, wherein the at least  
2   one interactive additive is present in an amount between 0.1% to 99% by weight  
3   of thermopolymeric switching medium.

1           28.    The thermal indicator as claimed in Claim 25, wherein the at least  
2   one interactive additive is present in an amount between 5% to 95% by weight of  
3   thermopolymeric switching medium.

1           29.    The thermal indicator as claimed in Claim 25, wherein the at least  
2   one interactive additive is present in an amount between 10% to 90% by weight of  
3   thermopolymeric switching medium.

1           30.    The thermal indicator as claimed in Claim 25, wherein the at least  
2   one interactive additive is present in an amount between 20% to 80% by weight of  
3   thermopolymeric switching medium.

1           31.    The thermal indicator as claimed in Claim 18, further comprising at  
2   least one emulsifier selected from the group consisting of lipids, long chain  
3   alcohols, lecithins, glycol lipids, quaternized amines with lipid tails, and charged  
4   ionic detergents, and combinations thereof.

1           32.    The thermal indicator as claimed in Claim 31, wherein the at least  
2   one emulsifier is present in an amount between 0.001% to 10% by weight of  
3   thermopolymeric switching medium.

1           33.    The thermal indicator as claimed in Claim 31, wherein the at least  
2   one emulsifier is present in an amount between 0.01% to 5% by weight of  
3   thermopolymeric switching medium.

1           34.    The thermal indicator as claimed in Claim 31, wherein the at least  
2   one emulsifier is present in an amount between 0.1% to 1% by weight of  
3   thermopolymeric switching medium.

1           35.    A thermal indicator for visually determining and monitoring the  
2   temperature of food products, comprising:

3           a)    a barrel having an orifice communicating with a cavity within said  
4   barrel, said barrel being adapted for insertion into the article to be monitored;

5           b)    an indicator disposed in said cavity and adapted for sliding travel  
6   therein between a retracted position and an extended position;

7           c)    means for resiliently biasing said indicator away from said retracted  
8   position and toward said extended position; and

9           d)    organic thermopolymeric switching medium for releasably retaining  
10   said indicator in said retracted position,

11          wherein said thermopolymeric switching medium, when at a temperature  
12   below the predetermined temperature, maintains said indicator in said retracted  
13   position, and when at a temperature equal to or higher than the predetermined  
14   temperature, yields to permit release of said indicator, said biasing means urging  
15   said plunger into said extended position for visual indication.

1           36.    The thermal indicator as claimed in Claim 35, further comprising at  
2   least one inert additive selected from the group consisting of sugars, salts,  
3   starches, cellulose non-melting metal filings, powdered plastics, polymers, silicon,

4 silicates, chromatography resins, ceramic resins, chalk, glass, sand, air, oils,  
5 water, and high boiling liquid polymeric materials, and combinations thereof.

1 37. The thermal indicator as claimed in Claim 18, further comprising at  
2 least one interactive additive selected from the group consisting of bee's wax, root  
3 extracts, long chain hydrocarbon analogs from the jojoba plant, petroleum  
4 distillation analogs, and synthetic organic analogs, and combinations thereof.

1 38. The thermal indicator as claimed in Claim 37, further comprising at  
2 least one emulsifier selected from the group consisting of lipids, long chain  
3 alcohols, lecithins, glycol lipids, quaternized amines with lipid tails, and charged  
4 ionic detergents, and combinations thereof.

1 39. The thermal indicator as claimed in Claim 38, wherein the inert  
2 additive is present in an amount between 0.1% to 99% by weight of  
3 thermopolymeric switching medium, the at least one interactive additive is present  
4 in an amount between 0.1% to 99% by weight of thermopolymeric switching  
5 medium, and the at least one emulsifier is present in an amount between 0.001%  
6 to 10% by weight of thermopolymeric switching medium.

1 40. The thermal indicator as claimed in Claim 39, wherein the inert  
2 additive is present in an amount between 5% to 95% by weight of  
3 thermopolymeric switching medium, the at least one interactive additive is present  
4 in an amount between 5% to 95% by weight of thermopolymeric switching  
5 medium, and the at least one emulsifier is present in an amount between 0.01% to  
6 5% by weight of thermopolymeric switching medium.

1 41. The thermal indicator as claimed in Claim 40, wherein the inert  
2 additive is present in an amount between 10% to 90% by weight of  
3 thermopolymeric switching medium, the at least one interactive additive is present  
4 in an amount between 10% to 90% by weight of thermopolymeric switching  
5 medium, and the at least one emulsifier is present in an amount between 0.1% to  
6 1% by weight of thermopolymeric switching medium.

1 42. The thermal indicator as claimed in Claim 41, wherein the inert  
2 additive is present in an amount between 20% to 80% by weight of  
3 thermopolymeric switching medium and the at least one interactive additive is

4 present in an amount between 20% to 80% by weight of thermopolymeric  
5 switching medium.

1       43. The thermal indicator as claimed in Claim 39, wherein the at least  
2 one interactive additive is selected from the group consisting of short and long  
3 chain alcohols, esters, acrylic esters, fluorinated hydrocarbons, docosanol (C22),  
4 tricosanol (C23), tetracosanol (C24), pentacosanol (C25), hexacosanol (C26),  
5 heptacosanol (C27), octacosanol (C28), nonacosanol (C29), triacontanol (C30)  
6 and extended analogs, and combinations thereof.